1,146,972

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,146,972

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COMPLETE SPECIFICATION

Improvements relating to Removable Closure Members for Containers

We, POROUS PLASTICS LIMITED, a company registered under the Laws of Great Britain, of Dagenham Dock, Essex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to removable closure members which allow the passage of gases out or or if desired into a container whilst preventing the passage of liquids. Thus one particular application of the invention is to a removable closure member, in the form of a screw cap, for a small container, such as a bottle, in which it is intended that liquids, which are liable to evolve gases, are to be stored and transported.

Examples of such liquids are household bleaches and disinfectants.

In addition screw caps embodying the present invention can be used as vent caps for electric batteries.

According to the present invention a removable closure member for an opening to a container which member allows the passage of gases whilst preventing the passage of liquids includes a top wall overlying the opening and incorporates a barrier layer impermeable to liquid but permeable to gas and is characterised by a self-supporting gas permeable backing layer affording an exposed outer surface and situated above and mechanically backing the barrier layer.

The backing layer may be of a rigid porous polymeric plastics material such as sintered high density polyethylene, and may have a pore size in the range 50—100 microns. The barrier layer may be a microporous plastics material, and may have a pore size in the range 1—5 microns.

In one form of the invention the removable closure member is in the form of a cap having a skirt provided with means, for example internal screw threading, for removably securing the cap on to the neck of a container, for example provided with a co-operating screw thread, and a top wall overlying the opening thereof.

A closure cap in accordance with the present invention may comprise a top wall having at least one hole extending therethrough to allow the passage of gas through the top wall, a skirt depending from the top wall provided with means for removably securing the cap onto the neck of a container and a gas permeable backing layer or wad located in the cap to cover the hole in the top wall and arranged so that in use it is pressed by the top wall against the edge of the opening of the container, the side of the wad remote from the top wall being covered by a layer resistant to the passage of liquid but permeable to gas.

In one form of the invention the barrier layer in use has its edge gripped between the margins of the opening of the container and an opposed surface of the cap and is of such rubber-like material that on slight compression it becomes non-porous and is of sufficient thickness to ensure a satisfactory seal with the edge of the opening to the container.

In an alternative arrangement the barrier layer is a layer of microporous material formed as a coating on a base layer of greater thickness than the said coating and in use the base layer has its edge gripped between the margin of the opening of the container and an opposed surface of the cap and is of such resilient material that on slight compression it becomes non-porous and is of sufficient thickness to ensure a satisfactory seal with the edge of the opening of the container.

The resistance of the microporous barrier to the passage of a liquid will depend on the surface tension of the specific liquid which is to be placed in the container, the contact angle between the liquid and the material of the microporous barrier, and the pore size

[*Price 4s. 6d.*]

of the pores in this barrier. Thus the particular pore size to achieve the necessary resistance to the ingress of liquid needs to be chosen bearing in mind the particular material of the barrier layer and the specific liquids which it is intended should be retained in the container.

For aqueous solutions, using plasticized polyvinyl chloride as the material for the microporous barrier it has been found that an adequate resistance to ingress of the solution into the barrier is achieved by employing a microporous barrier having a pore size not greater than 5 microns.

Thus in general for aqueous solution it is preferred that the pore size should be in the range 1—5 microns.

Conveniently the microporous material used for the barrier layer is a material disclosed and referred to as a surface zone in any one of the present applicant's British Patent Specifications Serial No. 1,099,676 or Serial No. 1,122,804.

Conveniently the microporous barrier may be attached to the inner face of the outer protective wall by a porous adhesive layer, which may be formed by a method disclosed in the present applicants' British Patent Specification No. 13960/65 (Serial No. 1,146,973).

Sealing means may also be provided to effect a seal between the protective outer wall and the edge of the opening to the container, when the closure member is in position on the container.

The sealing means may be provided by the barrier layer which may be formed of rubber-like material which on slight compression becomes non-porous the barrier layer overlying the opening and being of sufficient thickness to ensure a satisfactory seal.

It is to be understood that the term "rubber-like" is used herein to define a material which is easily compressible but which when subjected to only slight compression on removal of the compressive force returns to substantially the shape which it occupied before the compressive force was applied to it. The term is not intended to be limiting in any other way.

Alternatively the sealing means may be provided at least partly by a washer formed of resilient non porous material.

As a further alternative the barrier layer may be formed of unplasticized polyvinyl-chloride, for example that sold under the Registered Trade Mark Porvic, grade M, and the sealing means may be provided by a rubber washer.

As another alternative the sealing means may be provided by a layer of resilient porous material comprising a barrier support, which on slight compression becomes non porous, and which overlies the opening.

The barrier support may be a naturally occurring material, for example a leather.

Alternatively the barrier support may be derived from a fibrous material by impregnation with a natural or synthetic plastics material.

Alternatively the resilient porous material may be a mechanically entangled felt made from staple fibres by a needle punching process and impregnated with a polymeric plastics material, for example, the barrier support may be formed of a material disclosed and referred to as a fibrous base zone in the present applicants' British Patent Specifications Serial No. 1,119,573, Serial No. 1,099,676, or Serial No. 1,122,804.

It will be recalled that the resistance of the microporous barrier to the passage of a liquid is dependant among other factors on the contact angle between the specific liquid and the material of the microporous barrier.

Thus according to another form of the present invention at least one of the rigid porous polymeric plastics material, the barrier support, the microporous barrier or the adhesive layer is treated so as to deposit a silicone as a surface coating within the pores of the material.

The treatment may be with a solution of a silicone, for example that sold under the trade name I.C.I. F 132 or by treatment with a silicone as an emulsion, for example that sold under the trade names Midland Silicones M s 148 or I.C.I. M 478.

Alternatively the material of the barrier support, the microporous barrier or the adhesive layer may have a silicone intimately mixed with it prior to its formation into a porous material.

The silicone may be one disclosed in the present applicants' British Patent Specification Serial No. 1,107,782 or Serial No. 1,122,804.

The invention may be put into practice in various ways but five specific embodiments of the invention as applied to screw caps for bottles and similar containers will be described by way of example with reference to the accompanying drawings:—

Figures 1 to 5 are all longitudinal cross sections of screw caps in accordance with the present invention in position on the neck of a container.

Each of the screw caps has a circular flat top wall 10 from which depends a skirt 11 provided with internal screw threads 12. These co-operate with external screw threads 13 on the neck 14 of the container (not shown).

In the embodiment shown in Figure 1 the top wall 10 includes a protective outer wall 20 formed integrally with the skirt 11 from conventional materials, for example as a plastic moulding. In this embodiment the protective outer wall 20 is provided with an aperture 21 having a diameter about one third the diameter of the top wall 10 passing through the outer protective wall 20.

Located within the cap is a close fitting

disc 28 which provides a microporous gas permeable liquid impermeable barrier material 26 and a backing layer 25.

In this embodiment the barrier layer is a disc 26 formed of microporous rubber-like material having a pore size of about 5 microns. The minimum thickness which can be used for the backing layer 25 depends on the pitch of the screwthread 13 on the container, but it should be sufficient to provide for adequate compression of the disc to provide sufficient locking of the cap against vibration and also to provide an adequate liquid seal between the skirt 11 of the cap and the rim of the neck 14.

The particular material from which the disc is made will depend on the materials which it is intended to place in the container and it will be appreciated that plasticized polyvinyl chloride and elastomeric polyurethanes resist many forms of chemical attack.

In the embodiment shown in Figure 1 the disc 28 comprises a backing layer 25 of rubber-like porous material which, with a screwthread having a 3/16th inches pitch is 20—35 mils thick, on which is deposited a microporous barrier layer 26 as a coating 15 mils thick. It will be appreciated that such a material is advantageously provided by those materials disclosed and referred to as synthetic leather substituted in the present applicants' three British patent specifications referred to above.

In the embodiments shown in Figures 2 and 3 the protective outer wall is formed by a disc 29 of sintered high density polyethylene having a pore size in the range 50—100 microns. A suitable proprietory material is that sold by the applicants under the registered trade mark VYON.

This disc is located within flanges 30 upstanding from the top end 31 of the skirt 11 and, if the skirt is made of solid high density polyethylene, is conveniently joined to it by heat sealing. If the skirt is made of some other material a suitable conventional adhesive is used. The microporous barrier 22 or 26 with or without a barrier support 25 is provided in the same way as for the embodiment described in connection with Figure 1.

The methods and materials disclosed in the present applicants' British Patent Specification Serial No. 1,122,804 are particularly suitable for making a microporous barrier for use in these embodiments.

It will be appreciated that these embodiments provide a larger area through which gases can escape from the interior of the container and thus for a given required total gas flow out of the container the gas permeability of the microporous barrier can be decreased. This can be conveniently done by decreasing the pore size of the microporous barrier, as indicated, which has the advantageous effect of increasing the resistance of the barrier to the ingress of liquids.

In the embodiments shown in Figures 4 and 5 the screw cap is of the same general appearance and construction as the embodiment shown in Figure 1 but has a larger aperture 34 provided in the protective outer wall 20. The inner face 35 of the outer wall 20 at the edge of the aperture 34 is cut away to form a seating 36. The diameter of the external edge of the seating is of slightly smaller dimensions than the smallest internal dimension of the skirt 11 thus allowing a disc 37 of sintered granulated high density polyethylene to be placed in the seating thus closing the aperture 34 and completing the protective outer wall. The microporous barrier 22 or 26 with or without a barrier support 25 is provided in the same way as for the embodiment described in connection with Figure 1. The close fit of this last disc 22 and 26 retains the polyethylene disc 37 in position in the seating during use thus removing the need for glueing or heat sealing as required in the embodiments described in connection with Figures 2 and 3, but providing an area through which gases can escape from the interior of the container, which is almost as large as that provided by those embodiments.

WHAT WE CLAIM IS:—

1. A removable closure member for an opening to a container which member allows the passage of gases whilst preventing the passage of liquids including a top wall overlying the opening and incorporating a barrier layer impermeable to liquid but permeable to gas characterised by a self-supporting gas permeable backing layer affording an exposed outer surface and situated above and mechanically backing the barrier layer.

2. A removable closure member as claimed in Claim 1 in which the backing layer is of a rigid porous polymeric plastics material.

3. A removable closure member as claimed in Claim 1 or Claim 2 in which the backing layer has a pore size in the range 50—100 microns.

4. A removable closure member as claimed in Claim 2 or Claim 3 in which the porous polymeric plastics material is sintered high density polyethylene.

5. A removable closure member as claimed in any one of the preceding claims in which the barrier layer is a microporous polymeric plastics material.

6. A removable closure member as claimed in Claim 5 in which the microporous material has a pore size in the range 1—5 microns.

7. A removable closure member as claimed in Claim 5 or Claim 6 in which the barrier layer is formed of microporous unplasticised polyvinyl chloride.

8. A removable closure member as claimed in Claim 5 or Claim 6 in which the barrier

layer is a layer of microporous material formed as a coating on a base layer of greater thickness than the said coating.

9. A removable closure member as claimed in Claim 8 in which the base layer forms the backing layer.

10. A removable closure member as claimed in Claim 8 in which the base layer is additional to the backing layer.

11. A removable closure member as claimed in Claim 8 or Claim 9 in which the base layer is a mechanically entangled felt made from staple fibres by a needle punching process and impregnated with a polymeric plastics material.

12. A removable closure member as claimed in any one of the preceding claims in the form of a cap having a skirt provided with means for removably securing the cap on to the neck of the container, and a top wall overlying the opening thereof.

13. A closure cap comprising a top wall having at least one hole extending therethrough to allow the passage of gas through the top wall, a skirt depending from the top wall provided with means for removably securing the cap onto the neck of a container and a gas permeable backing layer or wad located in the cap to cover the hole in the top wall and arranged so that in use it is pressed by the top wall against the edge of the opening of the container, the side of the wad remote from the top wall being covered by a layer resistant to the passage of liquid but permeable to gas.

14. A removable closure member as claimed in Claim 12 in which in use the barrier layer has its edge gripped between the margin of the opening of the container and an opposed surface of the cap and is of such rubber-like material that on slight compression it becomes non-porous and is of sufficient thickness to ensure a satisfactory seal with the edge of the opening to the container.

15. A removable closure member as claimed in Claim 12 in which the barrier layer is a layer of microporous material formed as a coating on a base layer of greater thickness than the said coating and in use the base layer has its edge gripped between the margin of the opening of the container and an opposed surface of the cap and is of such resilient material that on slight compression it becomes non-porous and is of sufficient thickness to ensure a satisfactory seal with the edge of the opening of the container.

16. A removable closure member as claimed in any one of the preceding claims in which at least one layer of the top wall incorporates a silicone as a surface coating within the pores of the material.

17. A removable closure member as specifically described herein with reference to any one of the Figures of the accompanying drawings.

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Agents for the Applicants.

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1146972 COMPLETE SPECIFICATION

1 SHEET. This drawing is a reproduction of the Original on a reduced scale

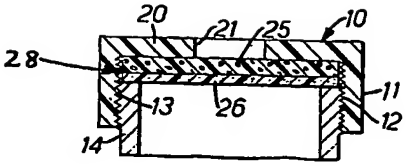

FIG. 1

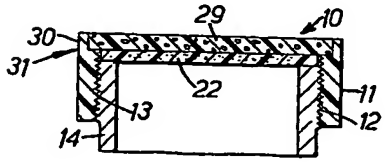

FIG. 2

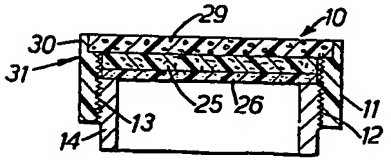

FIG. 3

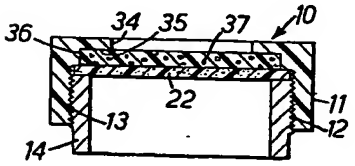

FIG. 4

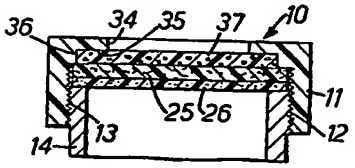

FIG. 5

DERWENT-ACC-NO: 1968-22939Q

DERWENT-WEEK: 196800

TITLE: A gas-venting plastics closure e.g. a bottle cap, has a barrier gasket permeable to gas but not to liquid, supported by a backing layer which is gas-permeable,

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Basic Abstract Text - ABTX (1):
A gas-venting plastics closure e.g. a bottle cap, has a barrier gasket permeable to gas but not to liquid, supported by a backing layer which is gas-permeable, self-supporting, and has an exposed outer surface.

Title - TIX (1):
A gas-venting plastics closure e.g. a bottle cap, has a barrier gasket permeable to gas but not to liquid, supported by a backing layer which is gas-permeable,

Standard Title Terms - TTX (1):
GAS VENT PLASTICS CLOSURE BOTTLE CAP BARRIER GASKET PERMEABLE GAS LIQUID SUPPORT BACKING LAYER GAS PERMEABLE